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**IMPROVEMENTS
IN GRADES OF HOGS SLAUGHTERED
FROM 1960-61 TO 1967-68**

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MARKETING RESEARCH REPORT NO. 849
ECONOMIC RESEARCH SERVICE
U.S. DEPARTMENT OF AGRICULTURE

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PREFACE

How much progress are U.S. farmers making in furnishing consumers the leaner pork they prefer? An answer to this question required detailed information on market attributes of slaughter hogs. The U.S. Department of Agriculture completed a survey of grades and measurements of hogs slaughtered in 1967-68, using procedures similar to those employed in 1960-61. This report analyzes and compares results of both surveys.

This study depended on the cooperation of approximately 50 U.S. meatpackers and their principal trade associations--the American Meat Institute, the National Independent Meat Packers Association, and the Western States Meat Packers Association. Their assistance is gratefully acknowledged.

The grading of the sample carcasses at individual plants was done by Carl Nelson of USDA's Consumer and Marketing Service.

U.S. official grade standards were used. These standards are based largely on backfat measurement in relation to length or weight, as supplemented by subjective rating of meatiness and lean quality.

Official U.S. standards for grading hog carcasses were revised effective April 1, 1968. The revised standards were applied to the carcasses examined to provide benchmarks for future studies of further improvement in market characteristics of hogs.

CONTENTS

	<u>Page</u>
Highlights	iv
Introduction	1
Procedure	1
Plants Visited.	2
Criteria for Evaluating Carcasses	2
Survey Findings.	5
U.S. Average Grades of Barrows and Gilts.	5
Grade Differences by Season	5
Backfat and Length of Barrow and Gilt Carcasses in Each Grade . . .	6
Barrow and Gilt Equivalent Grades Based on Measurements Only. . . .	7
1968 Revision of the Grade Standards for Barrow and Gilt Carcasses.	10
Appendix	11
Selection of Sample Plants and Composition of the Sample.	11
Backfat and Length of Barrow and Gilt Carcasses in Each Grade,	
1960-61	16
Average Length and Backfat Measurements for Each Grade.	16

HIGHLIGHTS

Leanness and lean quality of hogs marketed in the United States improved markedly during the 7 years 1960-61 to 1967-68, according to a nationwide study of hogs slaughtered. In 1967-68, 49 percent of barrows and gilts graded U.S. No. 1--leanest category of hogs with ample meatiness and lean quality--indicating a large increase from 33 percent in 1960-61. The percentage of U.S. No. 3's--fattest in relation to their length--decreased from about 26 percent to about 12 percent, and was roughly about the same as the increase in the proportion of U.S. No. 1's. The proportion of U.S. No. 2's decreased slightly --from 38 percent to 35 percent--while that of Medium and Cull remained less than 3 percent in both years.

Grade composition was determined and compared for two sample surveys of barrows and gilts--about 57,000 in 1967-68 and about 45,000 in 1960-61. These samples showed grades distributed as follows:

<u>Grade</u>	<u>1967-68</u> <u>Percent</u>	<u>1960-61</u> <u>Percent</u>
U.S. No. 1	49.9	33.4
U.S. No. 2	35.4	38.6
U.S. No. 3	11.9	25.9
Medium	2.6	2.0
Cull	<u>0.2</u>	<u>0.1</u>
	100.0	100.0

Carcass grades were obtained for 57,000 hogs during the 1967-68 season. Sampling techniques, grading standards, and the grading and measuring procedures used were comparable to those followed in an earlier study made in 1960-61. In the earlier study, about 45,000 barrow and gilt carcasses were sampled. U.S. official standards for barrow and gilt carcasses are based largely on objective measurement of backfat thickness in relation to length or live weight, as supplemented by subjective rating of specified meatiness and quality factors.

In the study, hogs were graded using standards in effect from July 5, 1955, to April 1, 1968. Grade proportions were also estimated using the revised standards announced by the Department effective April 1, 1968. Under the revised standards about 8 percent of the barrows and gilts examined in 1967-68 would have graded U.S. No. 1 under the new standards. The new U.S. No. 1 grade is limited to superior meaty carcasses rated as No. 1 or Medium under the older grade standards.

The study covered about one in every 1,000 hogs slaughtered in the United States. Samples were graded for 121 full-day kills in 56 federally inspected slaughtering plants throughout the United States. The sample was chosen to represent all hogs in all seasons and regions. The resulting estimate for barrow and gilt carcasses is considered to be accurate within 1.5 percentage points.

In addition to documenting the degree of improvement already attained in market quality of hogs, this study provides useful benchmarks for future measures of further improvement in grades as U.S. hog breeders and feeders continue their efforts to tailor hogs more closely to consumer preferences for leaner pork.

IMPROVEMENTS IN GRADES OF HOGS SLAUGHTERED FROM 1960-61 TO 1967-68

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INTRODUCTION

There has been general agreement that hogs "grade better" than they did several years ago, but estimates of the degree of improvement vary from "some" to "a lot." Accurate measurement of changes in hog quality over time helps to guide further adjustments in breeding, feeding, and marketing practices. A marked increase in the proportion of top-grade hogs among total butcher hogs marketed by U.S. farmers would represent important progress in tailoring physical characteristics of hogs to consumer preference for leaner pork.

Lard yield and cutout data, such as percentage of four lean cuts relative to carcass weight, provide additional indicators of leaner, meatier hogs. Official estimates show that average lard yield per hog slaughtered decreased more than 25 percent between 1952 and 1967, with most of the decrease occurring since 1958. However, average lard yield per hog is not an altogether satisfactory indicator of improvement in market hogs. It gives no inkling of the distribution of hogs among the various grades. Cutout data show an increase in lean cuts relative to carcass weight, but cutout tests do not represent all hogs marketed.

For information on all hogs marketed, an extensive and detailed field survey was required to provide samples of adequate size in all hog-fattening regions of the United States during all seasons of the marketing year. Such a survey was made in 1967-68.

The grades and market quality of U.S. hogs slaughtered in 1967-68 were estimated on the basis of carcass measurements and grades derived from a nationwide survey of a representative sample of hog slaughtering plants between April 1967 and March 1968. The data from this survey were compared with data obtained in a similar survey made in 1960-61 to indicate the degree of improvement in market characteristics of the U.S. hog crop over the past 7 years. In both surveys, the same procedures and grading designations were used, so that direct comparisons could be made.

Procedure

A randomly selected sample of meatpacking plants was visited by a USDA meat grader. The sample plants were selected by a procedure similar to that used in the 1960-61 study. (See appendix for details of sampling scheme.) However, no attempt was made to select the same plants as in the earlier study

on each visit. The grader spent at least 1 day in each plant (2 days at five large plants), and visited each plant twice, 6 months apart. Samples were taken in 29 plants visited in the fall of 1967 and the spring of 1968, and in 31 plants in the summer and winter of 1967. The grader measured and graded a sample of each plant's production of hog carcasses as they moved along the kill line just before the carcasses went into the chilling cooler. Depending on the chain speed, the grader measured and graded every second, third, fourth, or fifth carcass moving along the line. During the 1-year survey, about 57,000 barrow or gilt carcasses were measured and graded.

Plants Visited

Locations of the meatpacking plants sampled and the boundaries of the geographic regions within which the sample was drawn are shown in figures 2 and 3 in the appendix. For the 1967-68 study, the sample was drawn from the 135 federally inspected plants which slaughtered 100,000 or more hogs in 1965. These plants accounted for 82 percent of 1965 total commercial slaughter and about 95 percent of federally inspected slaughter. In the earlier survey, federally inspected plants slaughtering 100,000 hogs or more accounted for 82 percent of total commercial slaughter and about 96 percent of federally inspected slaughter. In both surveys, 61 pairs of visits were made to 56 of these plants. Five plants fell into the sample twice so the grader spent 2 days at each visit to these plants.

Criteria for Evaluating Carcasses

The grader assigned a grade to each carcass included in the sample. In arriving at this grade, he measured carcass length (from the forward point of the aitch bone to the forward edge of the first rib) and computed average backfat thickness from three measurements made opposite the first and last ribs and the last lumbar vertebra. The data form used to record measurements and the information such as origin of the lot of hogs is shown in figure 4 of the appendix.

For barrows and gilts, average backfat thickness related to carcass weight or length is a major factor in grading. An accurate appraisal of expected yield and quality of cuts requires consideration of such additional factors as thickness of muscling and distribution of finish.

The weight and measurement guides in the official standards for grades of barrow and gilt carcasses prior to April 1, 1968, are given in table 1. ^{1/} These are the criteria that were used in grading hog carcasses in both surveys. Under these standards, the typical U.S. No. 1 carcass was expected to have a high yield of four lean cuts and the minimum fatness required to produce high-quality cuts. U.S. No. 2 carcasses were somewhat fatter, and U.S. No. 3 carcasses were decidedly overfat. Carcasses too thin to yield top quality pork cuts were designated Medium and Cull.

^{1/} U.S. Department of Agriculture. Official U.S. Standards for Grades of Pork Carcasses. (Barrow and Gilt: Sow) Agricultural Marketing Service. SRA 171. Apr. 1958.

Table 1.--Weight and measurement guides in official standards for grades of barrow and gilt carcasses, prior to April 1, 1968

Carcass weight or length 1/	Average backfat thickness by grade 2/					
	U.S. No. 1	U.S. No. 2	U.S. No. 3	Medium	Cull	
	<u>Inches</u>	<u>Inches</u>	<u>Inches</u>	<u>Inches</u>	<u>Inches</u>	
Under 120 pounds or under :						
27 inches..... :	1.2 to 1.5	1.5 to 1.8	1.8 or more	0.9 to 1.2	Less than 0.9	
120 to 164 pounds or 27 to :						
29.9 inches..... :	1.3 to 1.6	1.6 to 1.9	1.9 or more	1.0 to 1.3	Less than 1.0	
165 to 209 pounds or 30 to :						
32.9 inches..... :	1.4 to 1.7	1.7 to 2.0	2.0 or more	1.1 to 1.4	Less than 1.1	
210 or more pounds or 33 :						
or more inches..... :	1.5 to 1.8	1.8 to 2.1	2.1 or more	1.2 to 1.5	Less than 1.2	

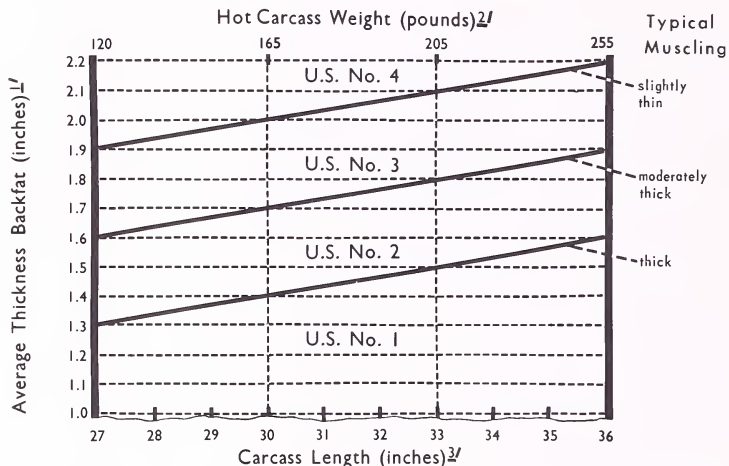
1/ Weight is based on a chilled, packer-style carcass. Length is measured from the forward point of the aitch bone to the forward edge of the first rib. Most carcasses of a given weight have the length shown for that weight in this table. For carcasses where weight (in relation to backfat thickness) indicates one grade and length indicates another, the grade is determined subjectively as provided in the standards.

2/ Average of measurements made opposite the first and last ribs and last lumbar vertebra.

Source: U.S. Department of Agriculture. Official U.S. Standards for Grades of Pork Carcasses (Barrow and Gilt: Sow). Agr. Mktg. Serv. SRA-171. 1958.

The 1968 revision in the grade standards for barrows and gilt carcasses 2/ is considered later in this report (p.10) and is illustrated in figure 1. U.S. grades for live hogs have been explained and illustrated in other Department of Agriculture publications. 3/ The history of the research and development of grade standards for hogs and carcasses has been given in another report. 4/

RELATIONSHIP BETWEEN AVERAGE THICKNESS OF BACKFAT, CARCASS LENGTH OR WEIGHT, AND GRADE FOR CARCASSES WITH MUSCLING TYPICAL OF THEIR DEGREE OF FATNESS.



1/ An average of three measurements including the skin made opposite the first and last ribs and the last lumbar vertebra. It also reflects adjustment, as appropriate, to compensate for variations - from - normal fat distribution.

2/ Carcass weight is based on a hot packer style carcass.

3/ Carcass length is measured from the anterior point of the aitch bone to the anterior edge of the first rib.

Figure 1

2/ U.S. Department of Agriculture. Standards for Grades of Barrow and Gilt Carcasses. Federal Register 33 (61)5081-5084. March 28, 1968.

3/ U.S. Department of Agriculture. Official U.S. Standards for Grades of Slaughter Swine (Barrows and Gilts; Sows.) Agricultural Marketing Service. SRA 172. April 1958.

Official U.S. Standards for Grades of Slaughter Barrows and Gilts. Federal Register, 33(81) 9249-9251. June 22, 1968.

How Do Your Hogs Grade? Marketing Bul. 16, 1961.

4/ Engelman, G. and Gaarder, R. O. Marketing Meat Type Hogs. Problems, Practices, and Potentials in the United States and Canada. Mktg. Res. Rpt. 227. 1958.

SURVEY FINDINGS

U.S. Average Grades of Barrows and Gilts

In the 1960-61 and 1967-68 surveys, the 1955 standards and designations were used. The estimated U.S. average grade distribution was:

	1967-68	1960-61
<u>Grade</u>	<u>Percent</u>	<u>Percent</u>
U.S. No. 1	49.9	33.4
U.S. No. 2	35.4	38.6
U.S. No. 3	11.9	25.9
Medium	2.6	2.0
Cull	<u>0.2</u>	<u>0.1</u>
	100.0	100.0

The estimates for grades of the entire year's barrow and gilt slaughter throughout the entire United States were made by combining quarterly estimates weighted by the volume of federally inspected slaughter in each quarter. The estimates of grades of the barrows and gilts slaughtered in each quarter were made by combining grade distribution, for each plant, after adjusting for differences among plants in sampling ratios and slaughter mix.

There was some variation among plants in the proportion of carcasses graded due to variance in chain speed. Samples taken at individual plants varied also as to the mix of slaughter among barrows and gilts, and sows and boars. However, since each plant in the sample represented approximately the same proportion of federally inspected slaughter in the previous year, it was possible to make adjustments to standardize the ratio of sample to kill and barrows and gilts to total. This was done separately for each season, and the composite results were weighted by the relative volume of federally inspected slaughter in each season.

Grade Differences by Season

The proportions of barrows and gilts in each grade varied seasonally. Comparisons by seasons were made for barrows and gilts slaughtered in the Western Corn Belt to indicate the degree of seasonal variation in the grade distribution there. The proportion of No. 1 hogs averaged 52 percent in January-February and 54 percent in April-May, compared with 48 percent in July-August and October-November. The higher proportion of No. 1 hogs in these seasons was offset by corresponding decreases in the proportion of both No. 2's and No. 3's (table 2).

There was some variation among seasons in percentage of hogs grading No. 1 in both years studied, but the seasonal variation was less in 1967-68 than in the earlier survey. In 1960-61, the percentage of No. 1's was 6 percentage points higher in December-January and 11 percentage points higher in September-October than the 29 percent No. 1's in March-April or June-August (table 3). But there was remarkably little variation between seasons in the percentage of

Table 2.--Comparison, by seasons, of distribution among grades for barrows and gilts slaughtered in 28 Western Corn Belt plants, 1967-68

Season	U.S. grade			
	1	2	3	Medium and Cull ^{1/}
	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>
April-May.....	54.4	33.3	9.7	2.6
July-August.....	48.3	36.8	13.3	1.6
October-November..	48.2	35.6	13.7	2.5
January-February..	52.2	33.6	9.8	4.4

^{1/} In these plants, Culls averaged 0.2 percent in January-February and less than 0.1 percent in the other quarters.

Table 3.--Comparison, by seasons, of distribution among grades for barrows and gilts slaughtered in 28 Western Corn Belt plants, 1960-61

Season	U.S. grade			
	1	2	3	Medium and Cull
	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>
March-April.....	28.5	37.2	32.8	1.5
June-July-August..	22.8	39.1	30.3	1.8
September-October..	37.9	39.4	21.4	1.3
December-January..	33.7	39.3	25.9	1.1

No. 2 hogs in both sampling periods. The season of the year with the highest percentage of No. 1 and No. 3 grades differed in the two surveys; but this might have been due to differences in sample plants in the seasonal subsamples.

Backfat and Length of Barrow and Gilt Carcasses in Each Grade

The percentage distribution within each grade of barrow and gilt carcasses according to their length and backfat measurements is shown in tables 4 to 7 for 1967-68 and in appendix tables 11 to 14 for 1960-61.

For each grade, the percentage distribution at each length and backfat combination is shown. The row labeled "Total" shows the percentage distribution by backfat thickness of all the carcasses in the grade; the column labeled "Total" shows the percentage distribution by length of all the carcasses in the grade. The row and column total in the lower right position of each table shows the percentage of all carcasses that fell into the grade shown.

Data in the tables also illustrate how the grader evaluated borderline carcasses. All entries in each table represent the carcasses placed in that grade by the grader. The boundaries of the official weight and measurement guides in effect while the study was being made are superimposed on each table. Carcasses outside these boundaries were placed within the grades indicated because of superiority (or deficiencies) in proportion or quality of lean musculing or variations in fat distribution.

In table 4, the increase in proportion of No. 1 barrows and gilts is shown to extend into the leaner categories of the grade measurements, compared with the earlier survey (appendix table 11).

Barrow and Gilt Equivalent Grades Based on Measurements Only

If the grading had been done solely on the basis of the measurement guides and no subjective evaluations used, the following barrow and gilt grade distribution would have resulted:

	1967-68	1960-61	Change from 1960-61
	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>
U.S. No. 1	38.7	30.4	+ 8.3
U.S. No. 2	37.6	38.3	- 0.7
U.S. No. 3	12.8	24.5	-11.7
Medium	10.3	6.3	+ 4.0
Cull	.6	.5	+ .1
	<u>100.0</u>	<u>100.0</u>	

For these estimates of alternate grades based on use of the objective factors only (i.e., the backfat thickness and carcass length), one-half the carcasses along the grade boundaries were allotted to each of the adjacent grades.

In actual practice, the grader supplements the measurement guides for grade with subjective appraisal of relative meatiness and relative quality. Subjective appraisal is applied routinely to all carcasses with backfat thickness corresponding to a grade boundary and to others displaying an usually high (or low) relative leanness for their measurements. Thus, a particular grade may include some carcasses from each of three measurement groups: Those within the defined length-backfat boundaries of the grade, those above the maximum backfat boundaries, and those below the minimum backfat boundaries (table 8).

The grader found in 1967-68, for example, that 10.32 percent of all barrow and gilt carcasses fell within the measurements of length and backfat for the Medium grade (table 8, line 4), but he rated four-fifths of this group--8.13 percent of the total (line 1)--as carrying enough relative meatiness and relative quality to be graded No. 1 on the basis of these subjective factors.

About three-fourths of the carcasses graded as U.S. No. 1 in both surveys --33.4 percent in 1960-61 and 49.1 in 1967-68--were so rated according to the objective criteria, and about one-fourth by the supplementary use of subjective

Table 4.--U.S. No. 1 barrows and gilts: Distribution of carcasses by length and average backfat thickness, as percentages of all barrows and gilts graded in survey, 56 packing plants, April 1967 through March 1968 ^{1/}

Carcass length (inches)	Average backfat thickness (inches)										Total
	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	Over 1.8		
	Percent										
25.0-25.9.....	*	2/	0.01	*	2/					0.01	
26.0-26.9.....	0.01	0.03	.06	0.03	0.02	*				.15	
27.0-27.9.....	*	.14	.23	.29	.42	0.07	*		*	1.15	
28.0-28.9.....	*	.44	.85	1.29	1.77	.86	0.03	*		5.24	
29.0-29.9.....	.01	.85	1.66	2.41	3.81	2.91	.19	0.01	*	11.85	
30.0-30.9.....	*	.01	1.73	2.27	3.74	5.29	1.68	.04	0.01	14.77	
31.0-31.9.....	3/*	*	.99	1.38	2.39	3.73	2.11	.06	*	10.66	
32.0-32.9.....			.30	.49	.84	1.29	1.18	.06	*	4.16	
33.0-33.9.....				.08	.16	.27	.42	.10	*	1.03	
34.0-34.9.....				.01	.03	.03	.05	.03		.15	
35.0-35.9.....					*	.01	*	.01		.02	
Total.....	.02	1.47	5.83	8.25	13.18	14.46	5.66	.31	.01	49.19	

^{1/} The grader recorded backfat and length to the nearest tenth inch. Data are not adjusted for differing volumes of federally inspected slaughter during the months of each trip.

^{2/} Interval between dotted vertical lines is the range of backfat thickness for each carcass length according to the weight and measurement guides in the official standards for U.S. No. 1. The guides show a common measurement borderline between grades; carcasses measuring exactly on the borderline are graded by further considering subjective grade factors.

^{3/} Less than 0.01 percent.

Table 5.--U.S. No. 2 barrows and gilts: Distribution of carcasses by length and average backfat thickness, as percentages of all barrows and gilts graded in survey, 56 packing plants, April 1967 through March 1968

Carcass length (inches)	Average backfat thickness (inches)										Total
	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	Over 2.1		
	Percent-										
24.0-24.9.....		1/		2/ *		*				0.01	
25.0-25.9.....		*		*		1/				.01	
26.0-26.9.....		0.02	0.07	0.07	0.01					.17	
27.0-27.9.....		*	.32	.44	.30	*		*		1.09	
28.0-28.9.....		*	.63	1.91	1.50	0.28	*		*	4.33	
29.0-29.9.....		.01	.78	4.44	3.62	.98	0.02	*		9.85	
30.0-30.9.....	*	*	.07	2.13	4.71	2.56	.34	*	*	9.84	
31.0-31.9.....	*	*	.01	.65	3.42	2.12	.69	*		6.90	
32.0-32.9.....		*	*	.11	1.21	.92	.47	0.01		2.73	
33.0-33.9.....				*	.11	.25	.22	.03	*	.62	
34.0-34.9.....					.01	.04	.04	.01		.10	
35.0-35.9.....					*	*	*	*		.02	
Total.....	.01	.05	1.89	9.78	14.90	7.18	1.79	.06	.01	35.67	

^{1/} Interval between vertical dotted lines is the range of backfat thickness for each carcass length according to the weight and measurement guides in the official standards for U.S. No. 2. The guides show a common measurement borderline between grades; carcasses measuring exactly on the borderline are graded by further considering subjective grade factors.

^{2/} Less than 0.01 percent.

Table 6.--U.S. No. 3 barrows and gilts: Distribution of carcasses by length and average backfat thickness, as percentages of all barrows and gilts graded in survey, 56 packing plants, April 1967 through March 1968

Carcass length (inches)	Average backfat thickness (inches)											
	Less than: (inches)	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.5- 2.9	Over 2.9	Total
									</			

1/ Vertical dotted line shows minimum backfat thickness for each carcass length according to the weight and measurement guides in the official standards for U. S. No. 3. The guides show a common measurement borderline between grades; carcasses measuring exactly on the borderline are graded by further considering subjective grade factors.

2/ Less than 0.01 percent.

Table 7.--Cull and Medium barrows and gilts: Distribution of carcasses by length and average backfat thickness, as percentages of all barrows and gilts graded in survey, 56 packing plants, April 1967 through March 1968

Carcass length (inches)	Average backfat thickness (inches)														
	Cull					Medium									
	Under: 0.8	0.8	0.9	1.0	1.1	Total	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	Total
25.0-25.9..		2/				0	1/		*3/			1/			*
26.0-26.9..	*	*	:			*	:		*			:			*
27.0-27.9..	*	0.01	*	:		0.01	:		0.05	0.06	*	:			0.11
28.0-28.9..	0.01	.01	0.01	:		.03	:	*	.07	.15	*	:			.22
29.0-29.9..	*	.01	.02	:		.03	:	*	.18	.30	0.02	:	*		.50
30.0-30.9..	.01	.01	*	0.02:		.04	:		.04	.26	.60	0.01:			.91
31.0-31.9..	*	*	*	.01:		.01	:		.03	.15	.43	*	:		.61
32.0-32.9..		*	.01	*	:	.01	:	*	.04	.16	*	*	:		.20
33.0-33.9..				:		:	:		*	.04	.05	*	:		.09
34.0-34.9..				:		:	:				.01	:	:		.01
Total....	.02	.04	.04	.03		.13		*	.37	.96	1.25	.07			2.67

1/ Interval between vertical dotted lines in right portion of table shows range in backfat thickness for each carcass length according to the weight and measurement guides in the official standards for Medium grade. The guides show a common measurement borderline at the upper boundary of the Medium grade; carcasses measuring exactly on the borderline are graded by further considering subjective grade factors.

2/ Dotted line in left portion of table shows minimum backfat thickness for Medium grade (maximum for Cull) for each carcass length as defined in the official standards for Cull.

3/ Less than 0.01 percent.

Table 8.--Distribution by grades, arrayed by increasing backfat thickness, of barrow and gilt carcasses of specified length-backfat groupings, 1967-68 and 1960-61 ^{1/}

Grade assigned compared : with grade-equivalent of measurements :	Grade equivalent of length and backfat measurements only					
	Cull :	Medium :	U.S. : No. 1 :	U.S. : No. 2 :	U.S. : No. 3 :	Total
	Percent	Percent	Percent	Percent	Percent	Percent
1967-68:						
Actual grade higher than: grade measurements....	0.47	8.13	2.47	0.95	<u>2/N.A.</u>	12.02
Actual grade same as : grade measurements....	.16	2.19	36.22	31.80	11.29	81.65
Actual grade lower than : grade measurements....	<u>2/N.A.</u>	0	0	4.88	1.44	6.33
Total.....	.63	10.32	38.69	37.63	12.73	100.00
1960-61:						
Actual grade higher than: grade measurements....	.40	4.62	3.90	2.44	<u>2/N.A.</u>	11.36
Actual grade same as : grade measurements....	.14	1.63	26.47	33.90	23.50	85.64
Actual grade lower than : grade measurements....	<u>2/N.A.</u>	0	.05	1.95	1.00	3.00
Total.....	.54	6.25	30.42	38.29	24.50	100.00

^{1/} Grade-equivalent based on only the objective factors (backfat-length measurements) in the U.S. official grade standards; actual grades are based on the objective factors supplemented by subjective factors as provided in the U.S. official grade standards.

^{2/} Not applicable.

criteria. Most of the latter were carcasses from the fatter half of the Medium grade that had indications of acceptable quality. ^{5/}

1968 Revision of the Grade Standards for Barrow and Gilt Carcasses

Effective April 1, 1968, official U.S. standards for grades of barrow and gilt carcasses were revised. The principal change was the addition of a new

^{5/} There seemed little or no measurable effect on the grade distributions that could be attributed to the use of a different grader in 1967-68 and the earlier survey in 1960-61. Comparisons of the two surveys were made of percentages of carcasses along grade boundaries and the proportions of these carcasses the grader placed in the higher or the lower grade; comparisons were also made of percentages of carcasses not along grade boundaries and the proportions that were placed in higher or lower grades than would be indicated by measurements alone.

U.S. No.1 grade. This new grade includes high cutability carcasses that are thickly muscled with acceptable lean quality. These were formerly graded either No. 1 or Medium. Most of the carcasses that formerly qualified for the No. 1 grade are graded U.S. No. 2 under the revised standards, along with a small number that do not meet the minimum muscling requirements added for the No. 1 grade. Carcasses formerly in the U.S. No. 2 and 3 grades will, for the most part, be graded U.S. No. 3 and 4 under the revised standards. The Medium and Cull grades were combined and renamed U.S. Utility. This grade includes carcasses that do not meet the lean meat quality requirements of the four numbered grades.

Also, in this revision, the weight and measurement guides are illustrated in chart form (figure 1) rather than in table form (table 1) as in the former grade standards. Estimated distributions under the revised grades for the 1967-68 carcasses provide another indicator of the nature and degree of improvement in the quality of hogs marketed. It is possible to estimate grades according to the revised grade standards, using the objective measurements and subjective ratings as recorded by the grader for each carcass. Estimates of grade distribution according to the revised standards represent only an approximation when made from the grader's records rather than from visual ratings of the actual carcasses. In this procedure, the carcasses were distributed according to length and backfat measurements. Grader notations were used in estimating the number to grade differently than indicated by objective measurements. This procedure yielded an estimate of approximate distribution of the barrow and gilt carcasses by grade, as shown in table 9.

The market significance of the 1968 change in grade standards and designations for barrow and gilt carcasses is that, as redefined, most of the total supply (about three-fourths) will fall into the two "middle" grades--U.S. No. 2 and U.S. No. 3--with a relatively smaller proportion represented by the totals at either end of the scale of grades--top grade (No. 1), or over-finished (No. 4). This approximate distribution among grades shows better balance under the new standards than under the old; and this distribution can contribute improved efficiency and accuracy for use of the grade standards in buying, selling, and pricing transactions.

APPENDIX

Selection of Sample Plants and Composition of the Sample

Figure 2 shows the location of meatpacking plants where samples were graded in 1967-68 and figure 3 shows the plants visited in 1960-61. Many plants were visited in both surveys.

The same procedures were used for selecting sample plants and drawing the sample in both surveys. From federally inspected plants slaughtering more than 100,000 hogs in the previous year, a sample of approximately 60 plants was drawn. ^{6/} In drawing the samples, each plant had a chance of being drawn that

^{6/} Plants slaughtering less than 100,000 hogs in the previous year were excluded to avoid problems in scheduling grader visits during his 4 itineraries. Many of these plants slaughter hogs only 1 or 2 days a week.

Table 9.--Comparison of distribution of barrow and gilt carcasses among grades using 1955 standards with estimated distribution using 1968 standards for 1967-68 and 1960-61 surveys

Year surveyed	1968 standards					
	U.S. No. 1 :		U.S. No. 2		: U.S. No. 3 : U.S. No. 4	
	Utility		1955 standards			
	Cull	Medium	U.S. No. 1	-	U.S. No. 2	U.S. No. 3
	-	-	-	Percent	-	-
1967-68:	-	-	-	-	-	-
1968 standards <u>1</u> /:	--	1.82	8.13		42.10	35.71
1955 standards...:	.16	2.66	49.23		---	35.71
1960-61:	-	-	-	-	-	-
1955 standards...:	.14	2.08	33.04		---	38.80
						25.94

1/ Estimates provided by Livestock Division, Consumer and Marketing Service.

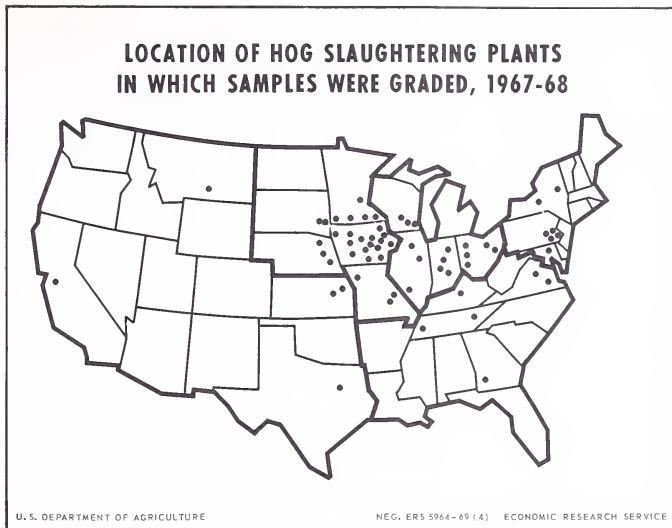


Figure 2

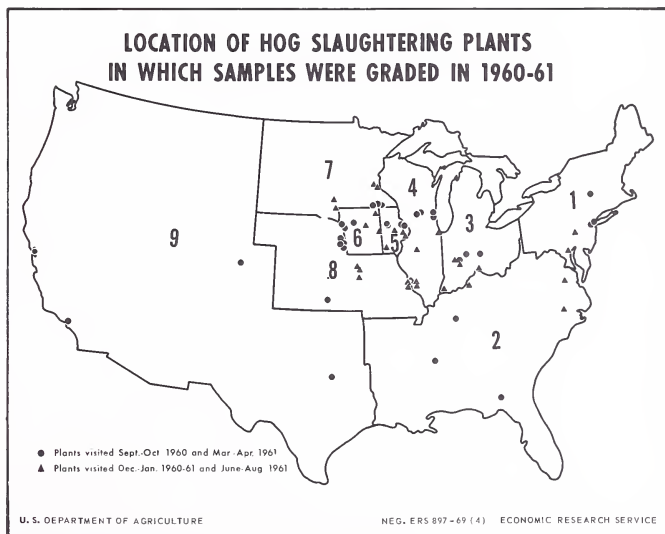


Figure 3

was proportional to its hog slaughter volume in the previous year. Drawing the sample was accomplished in three stages. The procedure included grouping the federally inspected plants which slaughter hogs in a logical order for travel, then arraying those in each region together with the number of hogs each slaughtered in the previous year, and showing cumulative total slaughter opposite each successive plant. A sampling interval was determined that would approximately divide the 62 million head of hogs slaughtered under Federal inspection the previous year among 61 plants (the number of plants represented in the final sample in the earlier study). 7/ This sampling interval was used to locate plants in which samples would be taken, commencing with a random number larger than 100,000 and smaller than 1,010,050, the sampling interval.

Therefore, each hog in the total population had about the same chance at being graded if the grader could grade the same number of carcasses at each plant. The grader accomplished this fairly well by staying at each plant throughout the full day's shift and grading at the rate of one carcass a minute while working. By staying throughout a full shift, he eliminated time of day as a possible source of variation in the results. Since some plants kill different types of hogs in separate lots, a full day's kill was needed to represent a plant's mix or consist accurately. Some firms concentrate sows or heavy hogs, or butcher hogs purchased on a grade-yield basis early or late in the shift. The grader, therefore, arrived at each plant well ahead of the time the killing shift was scheduled to commence.

After identifying the sample plants, contacts were made with officials of the firms operating these plants to enlist cooperation and make arrangements for the grader's visits.

In both surveys, the grader visited one-half the sample plants in each region during each of the four trips. He made two visits to each plant 6 months apart. The Southwest and West contained fewer hogs and fewer sample plants than the others and therefore gave rise to heavy travel costs because of distances between plants. Therefore, in both surveys, the grader's itinerary included visits to the plants in these regions during only two trips. Plants in the Western Corn Belt States were divided about equally between itineraries in both surveys, and most of the sample plants in the Eastern Corn Belt and Mid-Atlantic States were visited on the alternate itineraries from those in the Southeast, Southwest, and West (table 10). Thus, the Western Corn Belt and Eastern Corn Belt Regions were sampled in each quarter, and the other regions in alternate quarters but at the same rate. Since the bulk of the sampling for five regions was done during two of the four trips, data on grade differences among regions at different times during the sample year are not so complete.

For 1967-68, the 121 samples totaling 56,886 hog carcasses were drawn in 56 plants; the sample plants represented nearly 41 million hogs slaughtered (40,803,147) under Federal inspection in 1966. This was nearly two-thirds of the 64 million hogs slaughtered under Federal inspection throughout the United States in that year (table 10).

7/ Gaarder, R. O., Engelman, G., and Kimbrell, E. F. Grades of Hogs Slaughtered in the United States, September 1960 through August 1961. ERS-57. U.S. Department of Agriculture. April 1962.

Table 10.--Survey of grades of federally inspected hog slaughter--distribution of sample plants and all plants and hogs slaughtered, by regions, 1967-68 and 1960-61

Year and region 1/	Federally inspected plants slaughtering hogs						
	Commercial	Total		Slaughtering over 100,000 hogs			
	hog slaughter:	:	:	:	:	Sample	
	previous year:	Plants:	Slaughter:	Plants:	Slaughter:	Plants:	Barrows and gilts graded
	Mil. head	No.	Mil. head	No.	Mil. head	No.	No.
1967-68							
New England, Mid-Atlantic.....:	5.7	26	4.4	11	3.8	5	4,579
South Atlantic, South Central...:	14.6	54	8.7	32	7.7	6	5,237
Eastern Corn Belt:	17.8	50	14.0	35	13.5	19	17,505
Western Corn Belt:	37.2	56	31.7	44	31.6	27	27,449
Southwest, West...:	6.8	69	5.4	13	4.0	3	2,114
Total.....:	82.1	255	64.2	135	60.6	61	56,884
1960-61							
New England, Mid-Atlantic.....:	7.6	33	5.8	17	5.4	5	3,379
South Atlantic, South Central...:	11.4	45	6.9	27	6.3	6	3,747
Eastern Corn Belt:	20.2	50	16.0	35	15.3	15	11,737
Western Corn Belt:	35.0	55	34.3	44	34.1	31	23,980
Southwest, West...:	7.5	80	5.5	22	7.7	4	2,070
Total.....:	81.7	263	68.5	145	65.8	61	44,913

1/ Regional grouping following Census with the following exceptions: South Central includes Kentucky, Tennessee, Alabama, Mississippi, Louisiana, and Arkansas; Southwest includes Oklahoma and Texas; all sample plants in East St. Louis-St. Louis area grouped with East North Central States.

In 1960-61, the 121 samples totaling 44,913 hog carcasses were drawn in 56 plants; the sample plants were drawn from 145 federally inspected plants that represented nearly nine-tenths of 68 million head slaughtered under Federal inspection throughout the United States in that year.

Comparison of the proportions of the carcasses in the sample with federally inspected slaughter, by regions, in all plants and among sample plants for 1967-68 showed that the proportion of slaughter in the sample plants coincided reasonably well with that for all plants in most regions. In the other regions, discrepancies were largely offset by adjustments in sampling ratios (number of carcasses graded compared with the total slaughter) that were largely automatic because of higher chain speeds and some multiple shifts, or lower chain speeds, shorter kill shifts, and some skip-day slaughter schedules in other regions.

The grader's work procedures tended to reduce greatly any possible sampling errors due to differences among regions or firms in their grade mix of market hogs killed. By working at the rate of one hog per minute regardless of the chain speed throughout the entire hog slaughter shift in each sample plant each day, the grader obtained rather high sampling fractions in the sample plants. Averaged by region, the ratios of sample sizes relative to the total kill of hogs on the sample dates averaged about 1 to 6 for hogs slaughtered for the entire United States. It ranged from about 1 to 4 in the New England-Mid-Atlantic and the South Atlantic-South Central Regions, to 1 to 6 in the East North Central, and 1 to 7 in the West North Central Regions.

Backfat and Length of Barrow and Gilt Carcasses in Each Grade, 1960-61

Barrow and gilt carcasses in each grade in the 1960-61 survey are shown distributed according to their length and backfat thickness in tables 11 to 14.

In table 11, for example, which shows a total 33.04 percent of the barrows and gilts graded U.S. No. 1, the fifth line shows that 9.50 percent measured 29 to 29.9 inches in length, and the fifth column of this line shows that 3.78 percent measured 1.5 inches backfat thickness.

Comparisons of the data in tables 11 to 14 (for 1960-61) with the data in tables 4 to 7, (pp. 8-9) for 1967-68 show the details of the nature of improvement in leanness and lean quality of barrows and gilts between the 2 studies, thus supplementing the summary totals given in the text, p. 5. An additional indicator is average backfat thickness in relation to length for each grade, discussed below.

Average Length and Backfat Measurements for Each Grade

On the average, the hogs in each grade were somewhat longer in 1967-68 than in 1960-61; the average barrow and gilt carcass measured about one-third of an inch longer than 7 years ago in U.S. No. 1, No. 2 and No. 3 grades and about an inch longer in Medium grade (table 15). However, the average backfat thickness of all carcasses in each grade differed only fractionally (up to 0.02 to 0.03 inches) and was not always thinner. The reduction in fatness of hogs

over the years studied is thus shown by the change in grade distribution rather than by average measurements within grades. A larger proportion of the hogs fell in the leaner grades in 1967-68 than in 1960-61.

Form MR-60
Rev-(3-15-67)

U. S. DEPARTMENT OF AGRICULTURE
Economic Research Service
Marketing Economics Division
HOG CARCASS GRADE SURVEY

PAGE 15 of 20
PLANT CODE
DATE 1-26-68

START AND STOP TIMES	CARCASS LENGTH	AVERAGE BACKFAT THICKNESS	GRADE	COMMENTS
1	29.2	1.2	1	
2	28.1	1.8	2	
3	30.0	1.6	2	-1
4	29.5	1.6	2	
5	30.0	1.4	1	
6	28.1	1.2	1	+1
7	29.5	1.7	2	
8	31.9	1.4	1	
9	27.9	1.8	2	
10	31.9	1.2	1	
11	30.2	1.6	1	
12	29.3	1.5	1	+1
13	31.9	1.2	2	
14	31.5	1.8	2	504-1
15	28.0	1.4	1	
16	29.5	1.7	2	
17	31.9	1.7	1	+1
18	29.8	1.8	2	
19	30.2	1.2	M	
20	27.9	1.3	1	
21	31.0	1.8	2	
22	30.3	1.8	2	
23	28.7	1.9	2	+1
24	30.6	1.8	2	
25	30.2	1.6	1	
26	29.3	1.1	M	
27	29.8	2.0	3	
28	32.8	0.9	2411	
29	29.2	1.5	1	
30	27.2	1.3	1	
31	28.8	1.7	2	
32	28.5	1.7	2	
33	32.8	1.2	M	5228
34	29.6	1.7	2	
35	36.8	2.5	3	504W

Figure 4

Table 11.--U.S. No. 1 barrows and gilts: Distribution of carcasses by length and average backfat thickness, as percentages of all barrows and gilts graded in survey, 56 packing plants, September 1960 to August 1961 ^{1/}

Carcass length: (inches)	Average backfat thickness (inches)								
	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	Total
	-Percent-								
25.0-25.9.....		0.02	0.01	0.01	:				0.04
		<u>2/</u> :			<u>2/</u> :				
26.0-26.9.....	0.01	.03	.09	.07	0.01				.21
		:.....			:.....				
27.0-27.9.....	.01	.12	.35	.50	.36	0.02			1.36
		:			:				
28.0-28.9.....	.03	.26	.63	1.33	2.16	.42			4.83
		:			:				
29.0-29.9.....	.02	.24	.83	2.02	3.78	2.56	0.05		9.50
		:			:				
30.0-30.9.....	.01	.20	.72	1.50	3.18	3.18	.18		8.97
		:			:				
31.0-31.9.....	.01	.07	.40	.77	1.71	2.05	.27		5.28
		:			:				
32.0-32.9.....		.02	.10	.32	.69	.78	.32		2.23
		:			:				
33.0-33.9.....			.03	.05	.15	.19	.08	0.02	.52
		:			:				
34.0-34.9.....				.01	.02	.02	.03	:	.08
		:			:			:	
35.0-35.9.....					:	.01	.01	:	.02
		:			:			:	
Total.....	.09	.96	3.16	6.58	12.06	9.23	.94	.02	33.04

^{1/} The grader recorded backfat and length to the nearest tenth inch. Data are not adjusted for differing volumes of federally inspected slaughter during the months of each trip.

^{2/} Area between dotted lines is the range of backfat thickness for each carcass length according to the weight and measurement guides in the official standards for U.S. No. 1.

Table 12.--U.S. No. 2 barrows and gilts: Distribution of carcasses by length and average backfat thickness, as percentages of all barrows and gilts graded in survey, 56 packing plants, September 1960 to August 1961

Carcass length: (inches)	Average backfat thickness (inches)								
	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	Total
	----- Percent -----								
24.0-24.9.....	0.01	0.01							0.02
		<u>1/</u>			<u>1/</u>				
25.0-25.9.....		.05	0.03	0.01					.09
		:			:				
26.0-26.9.....	.02	.16	.30	.18	0.02				.68
		:.....			:.....				
27.0-27.9.....		.19	.93	1.02	.41	0.01			2.56
		:			:				
28.0-28.9.....		.08	1.27	3.30	2.16	.11			6.92
		:			:				
29.0-29.9.....		.03	.45	4.29	4.49	1.34	0.01		10.61
		:			:				
30.0-30.9.....			.09	2.68	4.35	2.39	.08		9.59
		:			:				
31.0-31.9.....			.04	.95	2.59	1.77	.17		5.52
		:			:				
32.0-32.9.....				.13	.91	.79	.23		2.06
		:			:				
33.0-33.9.....				.02	.19	.26	.11	0.01	.59
		:			:				
34.0-34.9.....					.03	.08	.04	:	.15
		:			:			:	
35.0-35.9.....						.01		:	.01
		:			:			:	
Total.....	.03	.52	3.11	12.58	15.15	6.76	.64	.01	38.80

^{1/} Area between dotted lines is the range of backfat thickness for each carcass length according to the weight and measurement guides in the official standards for U.S. No. 2.

Table 13.--U.S. No. 3 barrows and gilts: Distribution of carcasses by length and average backfat thickness, as percentages of all barrows and gilts in survey, 56 packing plants, September 1960 to August 1961

Carcass length: (inches)	Average backfat thickness (inches)									Total
	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	Over 2.5	
	Percent-									
25.0-25.9.....	1/ : 0.01	0.02	0.01	0.01	0.01					0.06
26.0-26.9.....	: .03	.10	.06	.05	.02	0.01	0.01	0.01	0.01	.30
27.0-27.9.....	: :04	.46	.50	.26	.17	.09	.04	.02	.03	1.61
28.0-28.9.....	: .02	.80	1.83	.81	.50	.28	.12	.08	.06	4.50
29.0-29.9.....	: : :	.32	2.46	1.44	.97	.58	.25	.14	.13	6.29
30.0-30.9.....	: : :	.12	1.80	1.77	1.10	.65	.35	.19	.26	6.24
31.0-31.9.....	: : :	.01	.70	1.15	.99	.52	.29	.19	.26	4.11
32.0-32.9.....	: : :		.14	.47	.47	.26	.22	.13	.16	1.85
33.0-33.9.....	: : :	.01	.03	.12	.15	.09	.12	.07	.10	.69
34.0-34.9.....	: : :		.01	.02	.04	.04	.03	.03	.04	.21
35.0-35.9.....	: : :			.01	.01	.01	.01		.01	.05
36.0-36.9.....	: : :				.01		.01	.01	.01	.04
Total.....	.10	1.84	7.54	6.11	4.44	2.53	1.45	.87	1.07	25.95

1/ Dotted line shows minimum backfat thickness for each carcass length according to the weight and measurement guides in the official standards for U.S. No. 3.

Table 14.--Medium and Cull barrows and gilts: Distribution of carcasses by length and average backfat thickness, as percentages of all barrows and gilts graded in survey 56 packing plants, September 1960 to August 1961

Carcass length (inches)	Average backfat thickness (inches)									Cull-- 0.8 and under
	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	Total	
	Percent-									
25.0-25.9.....	1/ : 0.01	0.01		0.02	1/ : :				0.04	0.01
26.0-26.9.....	: :	.01	0.04	.02	0.03				.10	.02
27.0-27.9.....	: : :	.01	.11	.07	.06				.25	.02
28.0-28.9.....	: : :	.01	.10	.19	.10	0.03			.43	.02
29.0-29.9.....	: : :	.01	.12	.21	.16	.04			.54	.03
30.0-30.9.....	: : :	.01	.09	.11	.14	.03			.38	.01
31.0-31.9.....	: : :		.04	.06	.08	.02			.20	.02
32.0-32.9.....	: : :	.02	.03	.03	.03	.02			.10	.01
33.0-33.9.....	: : :			.01	.02				.03	
Total.....	.01	.06	.52	.72	.62	.14	0	0	2.07	.14

1/ Area between dotted lines shows range of backfat thickness for each carcass length according to the weight and measurement guides in the official standards for Medium. Cull grade boundaries are not indicated.

UNITED STATES DEPARTMENT OF AGRICULTURE
WASHINGTON, D.C. 20250

OFFICIAL BUSINESS



Table 15.--Average length and backfat thickness for selected grades for barrow and gilt carcasses, 1967-68 and 1960-61

Grade and measure	Year		Change
	1967-68	1960-61	
	<u>Inches</u>	<u>Inches</u>	<u>Inches</u>
<u>U.S. No. 1</u>			
Length.....	30.43	30.12	+ .31
Backfat thickness..	1.51	1.48	+ .03
<u>U.S. No. 2</u>			
Length.....	30.29	29.90	+ .39
Backfat thickness..	1.79	1.77	+ .02
<u>U.S. No. 3</u>			
Length.....	30.36	30.09	+ .33
Backfat thickness..	2.13	2.16	- .03
<u>Medium</u>			
Length.....	30.53	29.41	+1.11
Backfat thickness..	1.14	1.14	0